Fluorine-19 nuclear magnetic resonance of chimeric antigen receptor T cell biodistribution in murine cancer model.

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Public Summary:
Discovery of effective cell therapies against cancer can be accelerated by the adaptation of tools to rapidly quantitate cell biodistribution and survival after delivery. Here, we describe the use of nuclear magnetic resonance (NMR) 'cytometry' to quantify the biodistribution of immunotherapeutic T cells in intact tissue samples. In this study, chimeric antigen receptor (CAR) T cells expressing EGFRvIII targeting transgene were labeled with a perfluorocarbon (PFC) emulsion ex vivo and infused into immunocompromised mice bearing subcutaneous human U87 glioblastomas expressing EGFRvIII and luciferase. Intact organs were harvested at day 2, 7 and 14 for whole-sample fluorine-19 (19F) NMR to quantitatively measure the presence of PFC-labeled CAR T cells, followed by histological validation. NMR measurements showed greater CAR T cell homing and persistence in the tumors and spleen compared to untransduced T cells. Tumor growth was monitored with bioluminescence imaging, showing that CAR T cell treatment resulted in significant tumor regression compared to untransduced T cells. Overall, 19F NMR cytometry is a rapid and quantitative method to evaluate cell biodistribution, tumor homing, and fate in preclinical studies.

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